

PREDICTING FINANCIAL DISTRESS USING THE ZMIJEWSKI MODEL IN MANUFACTURING COMPANIES WITH HIGH ESG SCORES

R. SRI HANDAYANI^{1*}, NURFITRIANI²

^{1*}DEPARTMENT MANAGEMENT, YOGYAKARTA UNIVERSITY OF TECHNOLOGY, INDONESIA

²DEPARTMENT ACCOUNTING, UNIVERSITY OF RIAU, INDONESIA

EMAIL: srih2488@gmail.com^{1*}, nurfitriani@lecturer.unri.ac.id²

ABSTRACT

This study analyzes the ability of the Zmijewski Model to predict financial distress. This study examined manufacturing companies with high ESG scores on the Indonesia Stock Exchange for the 2021–2023 period. The data used included audited financial reports to calculate ROA, Debt Ratio, and Current Ratio, as well as ESG Risk Ratings Sustainalytics scores. The sample consisted of 14 companies per year with a total of 42 observations. The analysis was conducted through X-Score calculations, healthy or distress classification, and prediction accuracy testing. The results showed that all companies had negative scores ($X < 0$) and were therefore categorized as healthy. The Zmijewski model achieved 100 percent accuracy without error, proving its effectiveness in identifying non-distress conditions. These findings also confirm that although some companies fall into the Severe Risk ESG category, this does not necessarily imply financial distress, so the Zmijewski model remains relevant for use in the context of manufacturing companies with high ESG scores.

Keywords: financial distress; zmijewski model.

INTRODUCTION

Financial difficulties (financial distress) is a condition that indicates a company's inability to meet its financial obligations and is often considered an early stage toward bankruptcy. Early identification of this condition is crucial for management, investors, creditors, and regulators in order to minimize risk and maintain business continuity. Various models have been developed to predict financial distress one of these is the Zmijewski Model (X-Score), which uses profitability, leverage, and liquidity indicators. Compared to other models such as Altman, Springate, or Ohlson, the Zmijewski model is relatively simple yet has proven to have a high level of accuracy, including in manufacturing companies in Indonesia (Pradana & Rahmawati, 2022).

As global awareness of sustainability issues grows, attention is growing to Environmental, Social, and Governance (ESG) aspects. ESG is viewed as a non-financial factor that influences a company's risk and performance. Companies with high ESG scores are assumed to have better governance, environmental compliance, and sensitivity to social issues, thus being better able to manage long-term risks. Several international studies have shown that good ESG performance can lower the cost of capital, increase financial flexibility, and reduce the likelihood of financial distress (Azevedo et al., 2024; Wu & Shen, 2023).

However, empirical phenomena in Indonesia show contradictory conditions. Based on data from 85 companies listed on the Indonesia Stock Exchange (IDX), the average ESG score was recorded at 28.6, which according to the Sustainalytics classification falls into the Medium Risk category. In fact, there are companies with high ESG scores such as PT Adaro Minerals Indonesia Tbk (54.02) which falls into the Severe category, while PT Pertamina Geothermal Energy Tbk has a very low ESG score (7.11) and is categorized as Negligible. This fact indicates that although ESG scores are often considered an indicator of protection against business risks, companies with high scores still have the potential to face sustainability risks and financial distress.

The relationship between ESG and financial distress are important to further examine. Good ESG can serve as a risk mitigation mechanism by increasing transparency, strengthening stakeholder relationships, and ensuring operational sustainability. Conversely, weaknesses in ESG aspects can increase the likelihood of financial distress because it increases exposure to environmental, social, and governance risks. However, the literature in Indonesia is still limited to studies that examine the influence ESG on profitability or market performance, while ESG integration with predictive models/financial distress, especially the Zmijewski Model, has not been widely studied.

Based on this, this study is important to address this gap in the literature by examining whether manufacturing companies with high ESG scores have a lower risk of financial distress when predicted using the Zmijewski Model. This study is expected to provide theoretical contributions by integrating financial and non-financial factors into a financial distress prediction model, as well as practical contributions for management, investors, and regulators in evaluating corporate risk more comprehensively.

METHODS

Types of research

This research is an explanatory quantitative study with a descriptive-verification approach. The quantitative approach was used because the research focuses on measuring the company's financial ratios to predict financial distress using the Zmijewski Model. Furthermore, this study integrates non-financial aspects, namely ESG (Environmental, Social, and Governance) scores, to assess the relationship between sustainability and the risk of financial distress in manufacturing companies in Indonesia.

Population and Sample

The study population comprised all manufacturing companies listed on the Indonesia Stock Exchange (IDX) and had ESG Risk Rating score data for the 2021–2023 period.

The sample was determined by the method/purposive sampling based on the criteria:

1. The company is included in the BEI manufacturing sector.
2. Companies have ESG scores categorized as High (30–40) or Severe (>40) based on the Sustainalytics methodology.
3. The company published complete annual financial reports for the period 2021–2023.
4. Based on these criteria, 14 companies were obtained per year, so that the total research observation units for three years were 42 data.

Data Collection

The data used in this study is secondary data, which includes:

1. Financial data: obtained from annual reports and audited financial reports of manufacturing companies published on the official BEI website and the websites of each company.
2. ESG data: obtained from Sustainalytics ESG Risk Ratings scores published through capital market databases or official Morningstar Sustainalytics sources.

Data Analysis Techniques

The analysis in this study focuses on measuring the accuracy of the Zmijewski Model in predicting financial distress in manufacturing companies with high ESG scores, the initial step is to calculate financial ratios (ROA, Debt Ratio, and Current Ratio) from the financial statements, then calculate the following Zmijewski score (Fauzi et al., 2021):

$$X = -4,3 - 4,5X_1 + 5,7X_2 - 0,004X_3$$

Information:

X = X-Score for the Zmijewski model

X₁ = Return on Assets (Net Income/Total Assets)

X₂ = Debt Ratio (Total Liabilities/Total Assets)

X₃ = Current Ratio (Current Assets/Current Liabilities)

Classification criteria: $X < 0$ = healthy (healthy) and $X \geq 0$ = distress (financial distress).

Next, the prediction results are compared with the company's actual conditions according to the Indonesia Stock Exchange to assess the model's accuracy and error rate. Correct predictions indicate a match between the model's results and the company's actual conditions, while incorrect predictions indicate a mismatch. Thus, this analysis allows for an assessment of the Zmijewski Model's accuracy in detecting financial distress, especially in manufacturing companies with ESG High and Severe categories.

RESULTS

To provide an overview of sustainability conditions, this study used 14 manufacturing companies with high ESG scores (in the High and Severe categories) during the observation period. The list of companies and their respective ESG scores are shown in the following table.

Table 1 List of ESG Scores of Manufacturing Companies on the IDX

Code	Company name	ESG Score
KLBF	Kalbe Farma Tbk.	31.41
ANTM	Aneka Tambang Tbk.	33.04
BRMS	Bumi Resources Minerals Tbk.	50.29
THAT	ESSA Industries Indonesia Tbk.	41.92
Asia	Astra International Tbk.	34.07
UNTR	United Tractors Tbk.	41.94
GGRM	Gudang Garam Tbk.	44.73

Code	Company name	ESG Score
ICBP	Indofood CBP Sukses Makmur Tbk.	32.99
INC	Indofood Sukses Makmur Tbk.	33.49
JPFA	Japfa Comfeed Indonesia Tbk.	42.61
LSIP	PP London Sumatra Indonesia Tbk	30.98
MIDI	Midi Utama Indonesia Tbk.	31.15
MYOR	Mayora Indah Tbk.	32.26
TAPG	PT Triputra Agro Persada Tbk	39.81

Based on ESG score data, the manufacturing companies in the sample showed a wide variation in sustainability risk, with the lowest score being 31.15 (Midi Utama Indonesia Tbk) and the highest reaching 50.29 (Bumi Resources Minerals Tbk). Most of the companies were in the high risk category (30–40), such as Kalbe Farma (31.41), Astra International (34.07), and Indofood Sukses Makmur (33.49), while several companies were in the Severe Risk category (>40), including Gudang Garam (44.73), Japfa Comfeed (42.61), United Tractors (41.94), and ESSA Industries (41.92). This condition indicates that although all companies had high ESG scores, there were significant differences in the level of risk faced, where companies with scores closer to the Severe limit were more vulnerable to sustainability issues that could potentially affect financial performance and risk.financial distress.

Table 2. Results of the Zmijewski Model Calculation

Code	Company name	Year	LONG	BUT	CR	Skor Zmijewski	Classification
KLBF	Kalbe Farma Tbk.	2021	0.13	0.17	4.45	-3.91	Healthy
		2022	0.13	0.19	3.77	-3.81	Healthy
		2023	0.10	0.15	4.91	-3.95	Healthy
ANTM	Aneka Tambang Tbk.	2021	0.06	0.37	1.79	-2.47	Healthy
		2022	0.11	0.30	1.96	-3.14	Healthy
		2023	0.07	0.27	2.34	-3.08	Healthy
BRMS	Bumi Resources Minerals Tbk.	2021	-0.03	0.45	0.01	-1.60	Healthy
		2022	0.01	0.12	2.77	-3.71	Healthy
		2023	0.01	0.12	1.73	-3.67	Healthy
THAT	ESSA Industries Indonesia Tbk.	2021	0.02	0.63	1.62	-0.80	Healthy
		2022	0.27	0.37	2.24	-3.41	Healthy
		2023	0.07	0.28	1.44	-2.99	Healthy
Asia	Astra International Tbk.	2021	0.07	0.41	1.54	-2.27	Healthy
		2022	0.10	0.41	1.51	-2.41	Healthy
		2023	0.10	0.44	1.33	-2.26	Healthy
UNTR	United Tractors Tbk.	2021	0.09	0.36	1.99	-2.67	Healthy
		2022	0.16	0.36	1.88	-2.98	Healthy
		2023	0.14	0.45	1.46	-2.36	Healthy
GGRM	Gudang Garam Tbk.	2021	0.06	0.34	2.09	-2.65	Healthy
		2022	0.03	0.35	1.90	-2.47	Healthy
		2023	0.07	0.34	1.83	-2.69	Healthy
ICBP		2021	0.07	0.54	1.80	-1.55	Healthy

Code	Company name	Year	LONG	BUT	CR	Skor Zmijewski	Classification
	Indofood CBP Sukses Makmur Tbk.	2022	0.05	0.50	3.10	-1.68	Healthy
		2023	0.07	0.48	3.51	-1.90	Healthy
INC	Indofood Sukses Makmur Tbk.	2021	0.06	0.52	1.34	-1.64	Healthy
		2022	0.05	0.48	1.79	-1.79	Healthy
		2023	0.06	0.46	1.92	-1.95	Healthy
JPFA	Japfa Comfeed Indonesia Tbk.	2021	0.07	0.54	2.00	-1.56	Healthy
		2022	0.05	0.58	1.81	-1.19	Healthy
		2023	0.03	0.58	1.61	-1.10	Healthy
LSIP	PP London Sumatra Indonesia Tbk	2021	0.08	0.14	6.18	-3.89	Healthy
		2022	0.08	0.12	7.20	-4.02	Healthy
		2023	0.06	0.09	9.53	-4.08	Healthy
MIDI	Midi Utama Indonesia Tbk.	2021	0.04	0.75	0.69	-0.25	Healthy
		2022	0.06	0.71	0.76	-0.50	Healthy
		2023	0.07	0.50	0.95	-1.77	Healthy
MYOR	Mayora Indah Tbk.	2021	0.05	0.39	4.11	-2.28	Healthy
		2022	0.09	0.42	2.62	-2.29	Healthy
		2023	0.14	0.36	3.67	-2.88	Healthy
TAPG	PT Triputra Agro Persada Tbk	2021	0.10	0.37	1.53	-2.61	Healthy
		2022	0.21	0.28	1.76	-3.65	Healthy
		2023	0.12	0.18	1.25	-3.81	Healthy

Based on the Zmijewski Model calculations, all manufacturing companies in the high ESG category in 2021 were in a healthy condition, with X scores less than zero. The average Zmijewski score for each company was recorded at -2.15, with a minimum value of -3.91 and a maximum of -0.25. This value indicates that although all companies were categorized as healthy, there were differences in the level of financial health between companies. Companies with scores approaching the zero threshold had a relatively higher risk than companies with much more negative scores. This condition indicates that, in general, manufacturing companies during this period were able to maintain their profitability, liquidity, and solvency, thus avoiding conditions financial distress, although some of them show potential vulnerability in the event of external pressure or a decline in financial performance in the future.

Table 3. Results of Accuracy Level and Error Model Zmijewski

Information		Prediction Zmijewski		Total
		Financial Distress Area	Non-Financial Distress Area	
Real	Non-Financial Distress	0	42	42
Accuracy level		100%		
Error rate		0%		

Source: Data processed by researchers (2024)

Based on the accuracy calculations of the Zmijewski Model, all 42 companies in the research sample were classified into the non-financial distress category, both based on actual conditions and model predictions. This is reflected in the accuracy rate reaching 100% and the error rate of 0%. These findings indicate that the Zmijewski Model has excellent capabilities in identifying the financial condition of manufacturing companies with high ESG scores, particularly in distinguishing companies in the healthy area from those in the potential distress area financial distress. Thus, this model has proven reliable for use as a predictive tool in the research sample, although it should be noted that no companies have yet been clearly categorized as distressed, so the model's ability to identify cases of distress cannot be tested in a balanced manner.

DISCUSSION

The results of this study indicate that all manufacturing companies with high ESG scores, both in the High Risk and Severe Risk categories, during the 2021–2023 period were in non-financial distress, based on the Zmijewski Model calculations. This finding is supported by a 100 percent accuracy rate and a zero error rate, indicating that all classifications performed by the model accurately reflect the actual conditions of the companies. This fact demonstrates the Zmijewski Model's excellent predictive ability in identifying healthy companies in the study sample.

This finding is in line with previous research that confirmed the superiority of the Zmijewski Model over other prediction models. (Saha & Ahmed, 2024) found that this model was more accurate than Altman, Springate, and Grover in detecting potential financial distress (Song, 2024) research also confirms the model's relevance in the energy sector, which shares similar characteristics with manufacturing in terms of capital intensity and risk exposure. The consistency of these findings strengthens the empirical evidence that the Zmijewski Model is a suitable predictive tool in emerging market contexts, including Indonesia.

Interestingly, despite several companies in the sample with ESG scores in the Severe Risk category, the calculation results show that their financial condition remains healthy. This indicates that high sustainability risk does not always equate to weak financial condition. (Antunes et al., 2023) also found that the relationship between ESG and financial distress is complex, while (Lohmann, 2024) emphasizes the importance of governance aspects that can maintain financial stability despite environmental or social pressures. Thus, this study confirms that the Zmijewski Model can effectively predict the financial condition of manufacturing companies with high ESG. Although further research with a broader sample size is needed to test the model's ability to detect real-world distress.

CONCLUSION

This study proves that the Zmijewski Model has a very high level of accuracy in predicting financial distress this study examined manufacturing companies with high ESG scores on the Indonesia Stock Exchange for the 2021–2023 period. All sample companies were classified as healthy with a negative Zmijewski score ($X < 0$), and the accuracy test results showed a 100 percent error-free value. This confirms that the Zmijewski Model is effective in identifying companies that are not experiencing distress. Furthermore, the results show that a high ESG score, even in the Severe Risk category, does not always imply a problematic financial condition. Therefore, this study emphasizes the importance of using the Zmijewski Model as a reliable financial prediction tool, while also demonstrating that ESG indicators and financial condition are not always directly correlated.

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